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ORIGINAL RESEARCH

Importance of Cheiloscopy

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ABSTRACT

Background and objectives: The professional moral of a dental surgeon is not only to treat the oral diseases of the community but also to serve its other legal services. Forensic odontology needs dental records for forensic identification, involving different and less-known techniques. These data can probably be fast and reliable processes in comforting the system and a person's life.

Keywords: Cheiloscopy, Forensic identification, Forensic odontology, Lip prints.

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INTRODUCTION

Method of Identification used in Forensic Dentistry

Cheiloscopy, palatoscopy, rugoscopy, teeth impressions, radiographs, bite mark analysis, DNA methods, etc. This article will discuss the importance of cheiloscopy in forensic dentistry, and how it can be useful in identifying a criminal.

The study deals with the examination of a system of furrows on the red part, or the vermilion border, of the human lips. The external surface of the lip has many elevations and depressions forming a characteristic pattern called lip prints, the examination of which is referred to as cheiloscopy or lip print analysis. Lip prints are unique and mostly unchanging during a period.

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MATERIALS

- A bright red-colored lipstick
- An applicator with a changeable brush tip
- A white bond paper (Table 1)

METHODS

The Selection and Grouping of Patients

A total of 90 individuals (45 males and 45 females) of rural and urban localities aged 15 to 57 years were selected. Of these, 56 were the natives of Patna, Bihar, India. To study the variation in age groups, the entire study population was divided into three groups: Group I – 20 years and below, Group II – 21 to 40 years, and Group III – 41 to 60 years (Table 2).

Those with any disease or deformity of the lips were excluded from the study.

The Method of Collection of Lip Prints

Several methods of recording lip prints were tried before the proforma method was finally selected. Written informed consent was taken from each of the participants. The consent for participants under the age of 18 years was taken from either of the parents.

The lips of the subject were first cleaned thoroughly. Then the subject was asked to open the mouth and lipstick was applied with a brush, uniformly on the lips. The subject

Table 1: Proprietary details of materials used

Materials used	*Proprietary name*	*Company*
Bright red-colored lipstick	Lakmé enrich lip color classics, no. 358.	Hindustan Lever Ltd., India
A4 sheet white paper	White bond paper	Century, India

Table 2: Age-wise distribution of cases

Age group (in years)	*Number of cases*
15–25	31
26–35	20
36–45	22
46–60	17

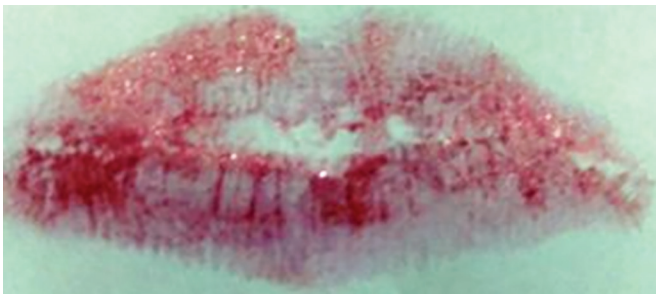

Fig. 1: Lip prints

was asked to gently rub his/her lips together to spread the lipstick evenly. The lipstick was allowed to dry for about 2 minutes, after which lip prints were taken on a piece of white bond paper (Fig. 1). The subject's serial number was written on the back of the paper to serve as a record. The predominant type of grooves was noted and they were classified according to Tsuchihashi's[1] classification from types I to V. The frequency of each type of lip print was tabulated and the percentage of each type was calculated.

RESULTS

Criteria for Classification of Lip Prints

The lip prints were classified using the classification given by Suzuki and Tsuchihashi[1] (Fig. 2)

Criteria for Sex Determination

The sex of the individual was determined as per the descriptions given by Vahanwala et al.[2,3]

Type 1: Pattern dominant – Female
Type 1′: Pattern dominant – Female
Type 2: Pattern dominant – Female
Type 3: Pattern present – Male
Type 4: Male
Type 5: (varied patterns) – Male
Same patterns in all quadrants – Female.
Following observations were made:-

- No two lip prints matched with each other, thus establishing the uniqueness of the lip prints.
- Types 1 and 1′ were most commonly seen in females whereas types 4 and 5 were seen most commonly in males (Table 3).

Table 3: Percentage of lip print types in males and females

	Percentage	
Type	*Male*	*Female*
I	11	12.5
I′	17	18
II	15	11
III	22	21.5
IV	32.5	34
V	1.5	2

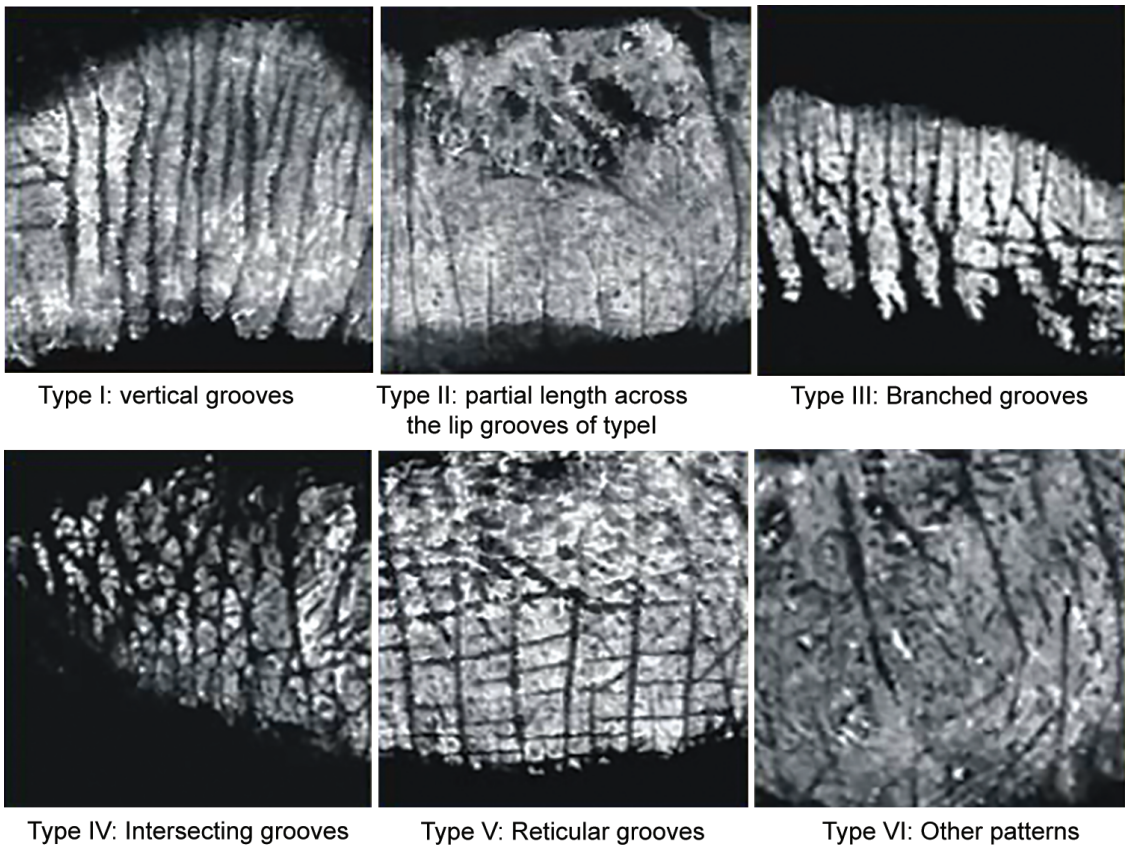

Fig. 2: Tsuchihashi's classification of lip prints; Type I – A clear-cut groove running vertically across the lip; Type II – Partial-length groove of type I; Type III – A branched groove; Type IV – An intersected groove; Type V – A reticular pattern; and Type VI – Other patterns

- Forty-four females were correctly identified as females and 43 males were correctly identified as males on the basis of their lip prints.
- Three cases were mismatched; two males were identified as females and a female as a male due to their lip patterns.

DISCUSSION

Other works on this topic have yielded varying results.

Fischer (1902)[4] was the first anthropologist to describe the furrows on the red part of the human lips.

Edmond Locard (1932),[5] one of France's greatest criminologists, was the first to recommend the use of lip prints in personal identification and criminalization.

Synder (1950)[6] had reported in his book Homicide Investigation that the characteristics of the lips formed by lip grooves are as individually distinctive as the ridge characteristics of finger prints. He was the first person who suggested the idea of using lip print for identification.

Dr. Santos (1967)[7] advocated that the nature of labial wrinkles and grooves could be divided into simple and compound types and it can further be subdivided into eight types by the application of individual queiloscopy to the personal identification. He then devised his own classification of lip grooves into four types, namely:

1. Straight line
2. Curved line
3. Angled line
4. A sine-shaped curve.

Suzuki et al (1967)[8] made detailed investigations of the measurement of the lips, the use and color of rouge, its differentiation from a blood stain, and the method for its extraction to obtain useful data for practical forensic application. It was concluded that lip prints made by rouge varied from individual to individual.

Suzuki and Tsuchihashi (1970)[9] had conducted a study in 107 Japanese families aged from 20 to 36 years. They had concluded that the groove pattern is present in the lips. This special structure, namely the grooves on the lips, has not been designated by any anatomical terminology; hence the grooves on the labiorum rubrorum were named as sulci labiorum and the lip prints consisting of these grooves were renamed as "Figura linearum labiorum rubrorum".

Ebihara (1971)[10] reported on the dissimilarity of kiss marks in relation to a suspected case of theft. Kiss marks were obtained using rouge from 30 adults consisting of 27 males and 3 females. He had concluded that each kiss mark showed a different pattern.

Hirth (1975)[11] had conducted a study on 500 persons, including 76 families with 133 children, 22 mono- and 17 dizygote twins. Lip prints were recorded for the study of variability and genetic basis of ridge pattern in the region of mucous membrane lips. It was observed that branched pattern is more frequently present in the upper lip and simple pattern was commonly seen in the lower lip. It was also reported that 30% of the lip prints showed whirling figures at the upper lip, namely simple and median, and in the lower lip, double and para-median were observed. Investigations during several months showed stability against environmental factors. Applications of cheiloscopy to genetic investigation are reported based on the results of twins and families.

The Federal Bureau of Investigation (1987)[12] had successfully identified a male bank robber who used female disguises including lipstick. Because of this disguise, the Federal Bureau of Investigation was looking for a female bandit. Using this disguise, the robber was successful in several other bank robberies. The robber had left his lip print on the glass door, when he ran into an exit door, while robbing a bank. The Federal Bureau of Investigation office submitted photographs and lifts of the lip print and the lip print was identified to match with that of the suspected robber. Thus, this investigation had proved the significance of lip print in criminal identification. The 1979 robbery was featured in an article in the 1987 issue of Old Farmers Almanac dealing with unusual bank robberies, and marked the first time when an individual was positively identified through lip prints by the Federal Bureau of Investigation.

Alvarez Segui et al (2000)[13] had conducted an investigation of persistent lipsticks and their lip prints as new hidden evidence at the crime scene. They have presented in their study the results of the latent lip print tests produced by permanent lip sticks using black-and-white ceramics, transparent green-colored glass, white cotton fabric, and white paper. In this study, the subjects were made to compress their lips on to the above-mentioned supports or print vehicles for 3 seconds, after the application of lipsticks on the lips of the subjects. The lip prints were developed using aluminum powder, cobalt oxide, and magnetic powder with intervals ranging from 2 hours from impression up to 30 days. The readings were undertaken independently by two observers and the results concluded that lip prints on ceramics and glass are highly favorable. The lip print on papers can be identified only up to 24 hours after impression, while no development was possible with fabric. The study also proved that cobalt oxide powder could produce little favorable result on ceramics, obtained over longer periods of time. However, on paper or fabric, no visible prints can be obtained. Aluminum powder and magnetic powder produced same results, but no latent prints were obtained on fabric materials. Hence, this study had reported the

significance of the use of latent prints during investigation at the crime scene, employing the same developing methods as that of finger prints but on different locations where lips are likely to have been placed. Thus, the latent prints are one of the most important forms of transfer evidence, which should not be overlooked.

Kasprazak (2000)[14] in his study of cheiloscopy had conducted a microscopic examination of lip prints collected from 1,500 individuals. He had stated that lip traces can only be revealed at the point of direct physical contact of the perpetrator's lip with an object at the scene of a crime like on the surface of the windows, paintings, doors, plastic bags, and cigarettes ends. Lip prints from these surfaces can be found and recovered using finger print powder and fixed on foil aqua print, or cyano-acrylamide may also be applied. He had reported that control prints from the suspects must be obtained after covering the mouth with skin care cream, following which a strip of paper 120 mm long and 45 mm wide, mounted on a profiled roller, must be gently pressed on the lips. The impression can further be visualized with the use of ferromagnetic powder and fixed on the transparent foil. The middle part of the lower lip 10 mm wide was taken for study and the predominant pattern was taken into consideration for classification. If the line pattern prevails, it is described as linear "L"; if bifurcation is dominant, it is called bifurcate "R"; and if the lines criss-crosses, the pattern is called reticular "S." In the case where no superiority can be established, the pattern is named undermined "N." The study of 400 lip prints in detail had revealed 23 types of individual features occurring in combination of two or more. He had also stated that the major difference between the properties of system of furrows on lips and those of finger print lines is that an element of an individual feature or the whole feature may appear as a part of another feature. The result of this study has led to the invention of a set of useful practical methods of lip print analysis.

Wilkinson et al (2003)[15] have conducted a study of the estimation of the mouth width and lip thickness from the skull for facial reconstruction in 95 subjects. The study proved that lip thickness is positively related to the height of the teeth. The study also concluded that inter-limbus distance serves as an indication of mouth width and this relationship exhibits no differences between men and women.

Utsuno et al (2004)[16] conducted a preliminary study of postmortem personal identification of lip prints. The aim of this study was to evaluate and confirm that postmortem lip prints taken from human remains, which are subjected to physical and chemical changes, can be used similarly as living persons. The study was carried out in 6 cadavers for anatomy research consisting of 4 males and 2 females before and after 48 hours from fixation with 10% formalin. The lip print impression was taken using lip stick stain and then transferred to a cellophane tape. Anthropological measurements were made before and after fixation, and it was observed that the distance between the landmarks were shrunken in the horizontal axis (cheilion-cheilion) (2.69%) and enlarged in the sagittal axis (Labrale superiosis to stomion) (7.2%) and (stomion to Inferius labrale) (11.1%). Lip prints remain unchanged before and after fixation. The study concluded that lips shrunk on the horizontal plane and enlarged on the vertical plane on fixation with more enlargements noticed in the lower lip region, but lip prints remain unchanged and are not affected by fixation.

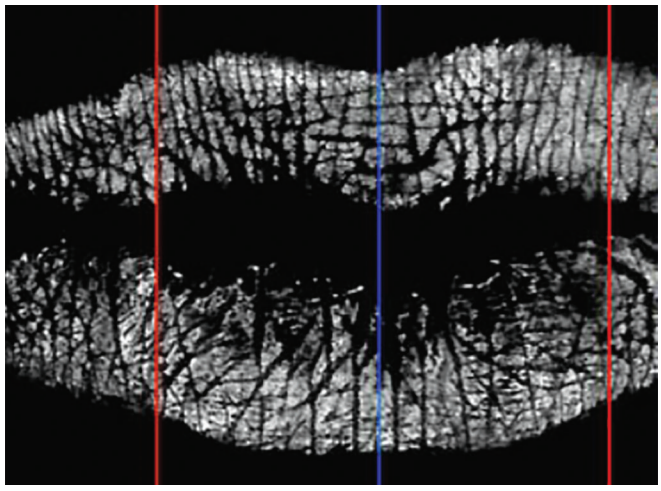

Fig. 3: Adobe Photoshop software used for analysis of lip prints

In one study, an analysis of lip prints was done by using an image scanner set at a resolution of 600 ppi. The images were inverted and scanned in grayscale. They were stored as TIFF (tagged image file format) files for maximum details. The most legible prints of both lips taken together on a cellophane tape were cropped and vertical lines drawn to divide the left and right sides. Each side was further divided into two equal parts using Adobe® Photoshop® 7.0 software (Fig. 3).[17]

CONCLUSION

It was observed that type IV was the most frequently observed in both the sexes. The study revealed that lip prints show racial differences that can be a useful adjunct to identification of a person. Cheiloscopy is a relatively new field among the large number of identification tools available to forensic experts. Work on this subject has already elicited useful information, for example, that lip prints are unique to an individual and can be used to fix the identity of a person, that they remain stable over time, and that they show gender differences. Further work on the subject can help to make cheiloscopy a practical reality at the ground level of the forensic identification process.

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